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10

THE MULTIPLIER EFFECT IN ACTION

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No single cause or factor can furnish a sufficient explanation for growth. Some authors have identified irrigation as the fundamental basis for various early civilisations (e.g. Wittfogel 1957) yet the foregoing discussion suggests that neither this, nor the invention and exploitation of metallurgy, nor yet the adoption of a redistributive system for agricultural produce can be singled out as the primary determining feature. Nor does population growth in itself explain very much. An adequate explanation can come only from the study of interactions of the various subsystems of the culture. A general model was outlined for this purpose, and a particular kind of interaction, the multiplier effect, identified as of crucial significance.

In this chapter the rise of prehistoric Aegean civilisation is viewed as a specific instance, a rather well-documented example, of a more general process for which the multiplier effect helps to furnish an appropriate model.

Several such models could be constructed for the Aegean culture changes observed. Here two alternative versions of the causal chain explanation are outlined. Both are, I think, plausible, and based upon the evidence now available. Both, as we shall see, have their limitations, and a broader perspective is then offered.

Subsistence/Redistribution Model

In terms of this model the decisive factor is the development of a redistributive system for subsistence commodities. This emerged as a consequence of the intensive exploitation of a new spectrum of food plants, notably tree crops, yielding a new diversity in produce.

General Statement

Adaptive transformations in human societies may be of three kinds. In the first there is a shift in the spectrum of environmental resources exploited: the exploitation of new resources and the more intensive use of certain traditional ones implies at the same time the reduction or cessation of exploitation of other resources. The most obvious example is the shift from hunting-gathering to food production. Another would be the replacement of stone tools by those of metal. The change in exploitation pattern is often accompanied by a shift in settlement pattern.

A marked increase in the efficiency of exploitation of a given range of resources is a second recurrent cause of societal transformations. In this case traditional resources are not abandoned, nor new ones utilised. The advance is in the field of exploitative efficiency, giving a greater *per capita* yield to the worker. Most subsistence advances are of this kind: irrigation agriculture is perhaps the most striking example.

A third transformation type is the effective enlargement of the range of resources successfully exploited. The traditional resources remain basic, but they are supplemented now by new ones. The first consequence is a new diversity in the range of products. Moreover if the resources in question are not competitors for land or for human labour, an increase in net production is possible. This increased production may permit a rise in population. More significantly the diversity in food products leads both to greater security (in that the failure of one crop need no longer be disastrous) and to some measure of specialisation in production. Some system of exchange is needed to utilise the specialist products. In favourable circumstances – and this depends largely upon the spatial distribution of the various resources – a redistributive system emerges in which the transfer of goods is centrally controlled. This is the locus for an emerging hierarchy of power and of wealth. This third transformation type is relevant to Aegean developments.

Analogy

An instance of a transformation of this third type is afforded by formative Mesoamerica, where several micro-environments are available (Flannery and Coe 1968). While one response is the intensive exploitation of one micro-environment, another is the exploitation by villages located in each, even in those regions which taken alone could not support a self-sufficient village. Permanent settlement is achieved by means of co-operative specialisation. The social correlates of such an adaptation appear to be a redistributive

system, and its control by persons of high status.

Initial Conditions

By 4000 BC mixed farming was successfully conducted in every major region of the Aegean. The chief product was grain – wheat or barley – and the fertile plains of northern Greece in particular were intensively farmed. The distribution of tell sites emphasises the intensity of exploitation of suitable arable land. Other settlement types naturally used other resources, especially in south Greece – the fishing village of Saliagos is an example – but such settlements were fewer and smaller. Thus while several micro-environments were exploited, fertile arable lands were preferred and most intensively cultivated. There is little evidence for craft specialisation or for a strong hierarchical social structure. Trade was on a limited scale on the basis of reciprocity.

Causal Factors

1. It is suggested that the domestication of the vine and especially the olive early in the third millennium BC made possible the intensive exploitation of a new micro-environment – the hill slope below 700 m, receiving abundant sun, little rain and no winter frost.

2. The terrain in south Greece is such that a single village can be within reach of both arable land and of hill slopes suitable for olive cultivation and viticulture. The suggested consequence is that a redistributive system emerged *with* the village, favouring the emergence of local chieftains.

A rise in population is expected, since the olive and vine do not compete for land with the cereals, and require labour at periods other than those critical for agriculture.

3. The concentration of commodities for redistribution in the lands of the central 'chief' favours a development at the same spot of specialised services for the community: the smiths and other specialist craftsmen are organised by the chief and live near him. The increased village population reaches the threshold level to support craft specialists. A nucleus of craft specialisation thus occurs at village level in what is still basically a subsistence economy.

Aegean Development

1. The domestication of the vine was accomplished in the Aegean by the third millennium BC, as the evidence from Sitagroi shows. Finds of olive oil and olive stones from early bronze age Crete and the Cyclades, and the use of oil lamps, document the exploitation of the olive. The adoption of Mediterranean polyculture at this time is strongly suggested by the new distribution of settlements in the southern Aegean, in areas of true Mediterranean climate.

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2. Settlement survey indicates a marked rise in population throughout the southern Aegean at this time, while in the north, where olive cultivation is less easy, population apparently increased more slowly.

The use of seals and sealings graphically documents the developing organisation of the redistribution system.

3. Large central buildings and indications of wealth document the emergence of a hierarchical order. Various new products – metal, ivory seals, faience – indicate craft specialisation, documented too by finds of specialised tool kits.

4. The nucleus of craft specialisation at village level, seen clearly at Myrtos, at Lerna and at Chalandriani, is already a palace economy in microcosm. There is little in the palace communities of second millennium Crete and Greece not already foreshadowed in the proto-urban settlements of the third-millennium southern Aegean.

No attempt has been made to frame these observations as 'predictions' arising from the 'hypotheses'. Yet the model does have its prescriptive (and hence predictive) elements. It predicts that in areas of productive diversity (in terms of Mediterranean polyculture: olive and vine as well as cereals) and *only* in such areas will such a redistributive system emerge. It predicts a greater population growth rate in regions of the Aegean with true Mediterranean climate. And it predicts the development of craft specialisation in precisely those areas and not in others. These predictions are not contradicted by our present knowledge of the third millennium Aegean, but the evidence available is not yet sufficient to try them effectively. Further work will test their validity.

Craft Specialisation/Wealth Model

The decisive factor is here viewed as the emergence of a stratified society, where high status correlates with material wealth and military prowess. These features arose largely as a consequence of the development of metallurgy and of maritime trade.

General Statement

A prerequisite for any society with marked internal differentiation (hierarchy, craft specialisation, etc.) is a subsistence system where the food produced will support more than those directly engaged in producing it. Many food-producing communities have a population level lower than full exploitation of their resources would permit. Moreover the *per capita* agricultural production could be increased, were this desirable to the producers, by the greater *per capita*

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investment of labour. An increase can arise when the agricultural producer, in exchange for his produce, can acquire attractive and desirable goods which will serve to enhance his status, and offer opportunity for the display of wealth. The craft specialist supported in this way supplies goods to an acquisitive society, where social status is closely and competitively linked to the display and consumption of wealth. Hostility and warfare are accompanying features.

Analogy

The concept of wealth expressed in goods other than food products is influential in nearly all societies developing beyond the level of a subsistence economy. The precondition for 'take-off' into sustained growth for an industrial society, as described by Rostow (1953) are precisely that production, including agricultural production, be stimulated by a demand for goods, stemming from a propensity to consume them. Although no prehistoric society was an industrial society in this sense, a clearly analogous process may be identified, where the demand for goods must be recognised as a significant factor favouring increase both in craft and subsistence production.

Initial Conditions

By 3500 BC essentially self-sufficient villages throughout the Aegean co-existed in relative tranquillity. There is no evidence for high status or pronounced social hierarchy. *Spondylus* bracelets and stone axes are the only prestige objects known. Besides a local reciprocal transfer of such prestige objects, obsidian – a utilitarian material – was collected from the island of Melos and transferred on land on a basis of reciprocity. The smelting of copper was understood, although not intensively practised: the products were awls, pins and small objects, as well as thick flat axes, none of which carried a special prestige significance.

Causal Factors

1. It is suggested that the alloying of copper with tin to form bronze allowed in the third millennium, for the first time, the production of a range of weapons able to bestow status and superiority in combat upon their owners. Metallurgical skills produced plate and jewellery of precious metal, incomparably finer as prestige objects than anything formerly available.

2. The geography of the Aegean is such that, given adequate shipping, maritime contact and the search for raw materials rapidly spreads any innovation of form or technique throughout the area. An effective enlargement of the cultural unit from the technological point of view (although not from the political) is the suggested consequence of any major technological discovery.

3. The demand for these new commodities favours specialisation in metallurgy and other crafts. The specialists would normally be supported within the original social framework, that is to say at village level. In consequence the status of the village chief, as controlling their production, would be increased, and expressed more conspicuously by fine metal goods and other objects.

4. The covetable nature of the craft products effectively established their position as wealth. Competition for their acquisition can be expected to lead to hostility and warfare, no longer disputing solely territories but also the ownership of goods.

Aegean Development

1. An astonishing range of metal types is seen in the Aegean from the Early Bronze 2 period – weapons, tools, plate and adornments. The value to their owners is eloquently indicated by the dagger burials (of the Cyclades for instance) and the great hoards of metalwork at Troy.

2. The distribution of metal types shows how widely and rapidly new forms were imitated. Pottery 'sauceboats', pottery *depas* cups and possibly marble folded-arm figurines, widely found in the Aegean imitate metal types.

3. Smithies and other craft-production areas have been found at Chalandriani, Myrtos, Raphina and other sites. Their control by the chief is hypothetical, but an increasingly pronounced hierarchy of wealth is seen in the graves. Fine daggers (anticipating the ceremonial longsword of Mallia), and silver or gold diadems, express the status of the leader.

4. Stone fortifications are now widely seen in areas where sudden attack from the sea was likely. In such areas there is evidence for a decline (or at least a retardation in growth) of population, and settlements were clearly sited with a view to effective defence.

This model again carries with it implications or associations which may be framed as predictions. For instance, regions rich in copper or tin ores should be outstandingly wealthy – a prediction not testable until a clearer picture is established of the original mineral resources available. Indeed so effectively does the model relate the features observed, which are already based upon substantial evidence, that further predictive tests are not obvious. Predictive power is not the sole criterion, however, for scientific validity: an explanation which simplifies the problem by relating its parameters is not to be dismissed merely as a logical exercise simply because many such relations are *already* documented. For they are not *finally* established: the generalisations and conclusions are always

based upon the limited collections of data available at the time in question. They remain corrigible in the light of further research.

Both these models can be more effectively expressed in systems terms as outlined above. There is no prior external variable in either. In the subsistence/redistribution model, the determining event was the domestication of the olive, a plant apparently locally available. In the craft specialisation/wealth model the initial event was the inception of effective bronze metallurgy. Both these initial advances are themselves to be explained within the context of the culture system. The strength of the systems approach is that neither has to be regarded as a prior event, a *fait accompli* initiating the causal chain. Bronze metallurgy undoubtedly came about because of growing interest in the production of the coppersmith; there is a positive feedback relation between supply and demand, between production and the social impact of the product. The same may be true of the domestication of the olive: the olive may have been domesticated, and the vine too, because the juices expressed from the fruit (initially the wild fruit) contributed to the diversity of the subsistence system.

Both models are in large measure substantiated by the data at present available. The predictions of one do not contradict those of the other, although both claim to 'explain' the emergence of a social hierarchy. Yet the two are not simply different expressions of a single theory: they isolate different factors, and proceed to different (although not contradictory) conclusions. They are, to a large extent, complementary, and both could be entirely valid. In effect they are tracing different causal chains among the subsystems of a system where the linkages are exceedingly complex. Many more such models could be created, all equally valid, and all incorporating permutations and combinations of the interactions between the subsystems.

This proliferation of possible models is simply a consequence of the extreme complexity of the system whose growth we are seeking to explain. As indicated above, any human society may be represented as a system: among so many interactions a whole series of feedback loops may be traced, all of them legitimately 'explaining' change in the society.

Such 'explanations' are limited, relating together only some elements of the system, and a 'total' explanation may hardly be possible. None the less a more general treatment can be undertaken in terms of the multiplier effect.

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The conditions favouring growth can be documented much more simply in terms of the multiplier effect, 'this mutual interaction in different fields of activity, this propensity of human systems that an innovation (and its adoption) in one subsystem favour innovation in another, this interdependence among subsystems which alone can sustain prolonged growth' as outlined earlier. The interactions between the subsystems are of crucial importance. They may be expressed as in figure 1, which does not in any way indicate relations between the culture and its environment, since aspects of both are included in each subsystem. It indicates rather the thirty different possible interactions among these subsystems ($A \rightarrow B$ and $B \rightarrow A$ are reckoned as separate interactions). Population is not in this sense a subsystem of society but a parameter, whose value is influenced by and influences each of the subsystems defined.

Culture, as we saw earlier, is essentially a homeostatic device, a conservative influence ensuring that change in the system will be minimised. It is a flexible adaptive mechanism which allows the survival of society despite fluctuations in the natural environment. Culture consists, of course, of patterns of learnt activity. These are therefore repetitive patterns: in similar circumstances a given action will normally be performed in the same way as on previous occasions. In each subsystem this determination of activity pattern by learning ensures that innovations are not readily accepted. By definition, what is new cannot have been learned through previous practice, and thus has no place in the existing cultural scheme of things. Wherever possible existing activity patterns will be adjusted to counteract the innovation.

Very few innovations within a functioning subsystem are accepted without strong opposition. The conservatism of non-industrial craft technology is well known: the village blacksmith is only gradually replaced by the engineering workshop. Forms of government, like forms of religion, are rigorously regulated by tradition and precedent. Even in contemporary societies this is a fundamental tenet of the law. Patterns of trade again show a long-term stability, especially when the trade implies social as well as commercial relations. And finally the subsistence basis of a society is not easily changed: pre-industrial man is nowhere more conservative than in his dietary tastes.

Strong social and religious sanctions proscribe most forms of innovation in a society: there is a negative feedback between the

other subsystems and the social and the projective systems. Population too is homeostatically regulated in many societies, although the ultimate homeostatic controls of famine (when population taxes the possibilities of the subsistence system) and disease are not often brought into play. Social factors – birth control, abortion, prohibitions on sexual intercourse, even the disposal of unwanted babies – ensure that the population does not normally increase very rapidly.

This conservative nature of culture cannot too strongly be stressed. In terms of our model it is the natural tendency of culture to persist unchanged – apart from a small random drift which arises from the imperfect transmissions of the cultural pattern between generations. It is change, any change, which demands explanation.

This complex of regulatory mechanisms operates so that even when change does occur in one subsystem, the effects upon the others are minimised. An innovation such as the smelting of copper may sometimes indeed be accepted in the craft technology subsystem as an alternative and shorter way of fulfilling an existing requirement, such as the manufacture of beads. On the other hand the production of new kinds of artefacts – new tools or weapons – would require new activities in a different subsystem to permit their use. Such new activities are not usually favoured.

The multiplier effect, where two subsystems enter into a *mutual deviation amplifying relationship* (mutual implies positive feedback), is needed to overcome this innate conservative homeostasis of culture. One or two examples from the early Aegean will illustrate this point.

The domestication of the vine in northern Greece during the fourth millennium BC may be regarded as an innovation solely within the subsistence subsystem. The vine was one of a wide spectrum of plants whose occasional use favoured gradual domestication and improvement, and whose gradual domestication favoured more frequent use. This is positive feedback within the subsystem. In a conservative society the dramatic intoxicating properties of new alcoholic drinks might at first seem socially and religiously undesirable, just as does the use of new stimulants in our own day, although they are prevalent without ill-effects in other societies.

When the subsistence innovation is answered by an innovation in another subsystem, the situation is transformed. If the festive potential of wine leads to the institution of social drinking, as the gold and silver drinking vessels of the Aegean third millennium

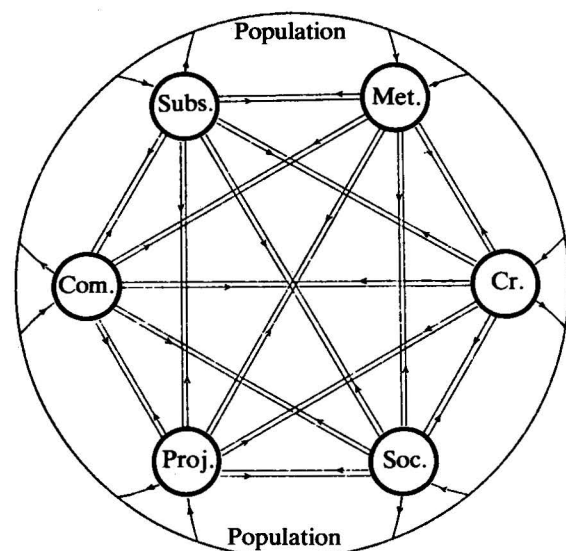


Figure 1. Interactions between the subsystems of the culture system. Sustained positive feedback between them – the multiplier effect – results in culture growth and development (see also table 1).

suggest, wine production is favoured. The increase in wine production leads to increased skill in manufacture and greater control over the product, which is thus improved, further favouring its wider adoption. Alternatively the intoxicated ecstasy produced may be recognised as of positive religious benefit; another positive feedback loop between systems is established. In both cases the multiplier effect comes into operation: there is a non-reversible growth both of the social (or religious) subsystem and in range and bulk of production in the subsistence subsystem. The society has grown a little, not merely in size but in complexity.

A small increase in the bulk of objects handled by the trading system, to take another example, may be of little apparent significance. Yet if it is coincidental with a development in craft technology the consequences can be dramatic. The production of the dagger in the third millennium BC gave the trader a new commodity. It coincided too with another development in craft technology, the creation of the longship. These both favoured an increase in trade (as did the need for raw copper). The increase in trade led to increased metallurgical production, to the discovery of new tech-

niques resulting from increased specialisation, and to the acquisition of new ideas and techniques from overseas. Trade and metallurgy grew together as neither could have done without the other.

It is interactions of this kind which make possible the sustained growth and development of new processes within society. The positive coupling of the subsystems overcomes the homeostatic controls which would otherwise stifle new development. Such interactions thus lie at the root of all growth and development within the culture.

The field of possible interactions, in terms of the subsystems which we have defined, as seen in figure 1, is given in table 1. These are the possible interactions which can permit the operation of the multiplier effect, and initiate sustained growth. The growth of any culture or civilisation may be considered and explained in these terms. The figures within the table refer to the specific case in question, the prehistoric Aegean, and are discussed below.

Table 1. Interactions between the subsystems of the culture system (and with population).

x:	Subs.	Met.	Cr.	Soc.	Proj.	Tr.	Pop.
y:							
Subs.	–	B1	B5	B2,B3,B4	B7	B6	B8
Met.		–	C1	C2,C3,C4		C5	
Cr.	D1	D4	–	D2	D5	D6	D3
Soc.	E1	E2,E3,E4	E2,E3	–	E5		E6
Proj.			F1,F5	F2,F3	–	F4	F6
Tr.	G1	G2,G3	G4,G5	G6	G7	–	
Pop.	A1		A4	A2,A5	A3		–

Growth in subsystem y favoured by growth in subsystem x through the mechanism indicated in the table (cf. list below). The subsystems listed are: subsistence, metallurgy, craft technology, social systems, projective and symbolic systems, trade and communication. Population is also included.

Factors and Interactions in the Third-Millennium Aegean

The emergence of Aegean civilisation has to be explained in terms of the positive interactions between the various subsystems which can be detected during the third millennium. The following summary lists such principal changes in each subsystem during the third millennium. Changes occurring in other subsystems which may have favoured these are indicated: they are noted in the appropriate

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space in table 1 above. The list begins with population and settlement which, although not constituting a subsystem of the culture system, are important features of it.

A. Population and Settlement

a) Population, as estimated on the basis of the number of settlements found, and their size, was increasing throughout the Aegean during the prehistoric period.

b) The growth rate was slow in north Greece, and much more rapid in the south.

c) In the two southern areas which of those surveyed had extensive arable land (Crete and Messenia), the rate of increase from neolithic to late bronze age seems to have been approximately exponential.

d) In the other southern areas surveyed, the initial increase was of the same order, but growth was markedly retarded at the time of the middle bronze age.

e) The size of neolithic village settlements in the Aegean was comparable with that of the smaller Near Eastern settlements. The increase in area from neolithic to early bronze age proto-urban settlement, and from early bronze age to late bronze age settlement was in each case by a factor of about 2. This is much less than in the Near East, where the growth was by a factor of about 10.

f) In neolithic times the settlements were generally not fortified. During the third millennium fortifications of stone are seen in eastern mainland Greece, the Cyclades and western Anatolia. By the late bronze age they are widely found throughout the southern Aegean, with the exception of Crete.

g) During the third millennium in certain maritime areas, notably the Cyclades, the number of settlements becomes smaller and the important sites larger in size. They are often located at some distance from the sea, in good defensive positions.

h) A hierarchy of settlements, in terms of size, may be recognised in the later bronze age of Crete, and in certain other regions of the southern Aegean.

i) Specialisation and differentiation of function within the settlements is documented by workshops and by large central buildings, first seen at this time.

Factors favouring population increase:

A1. Increased efficiency in food production, and increased diversity in crops grown.

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A2. Effective redistribution of foodstuffs within the social unit.

A3. Possible new social and religious beliefs reducing homeostatic control of population level (hypothetical).

A4. Improved medical knowledge, a special aspect of craft technology (hypothetical).

A5. Military security favoured by hierarchical organisation and practical defensive measures.

B. Subsistence

a) The later neolithic subsistence economy is marked by greater diversity in the range of crops, and greater specialisation, in that much purer crops were produced.

b) These tendencies continued into the early bronze age, when barley was more important than previously, and pulse crops played a major role.

c) Tree crops, notably the olive and the vine, were now domesticated. The fig was already exploited in the later neolithic.

d) Industrial products (olive oil and wine) were produced from the third millennium, and stored effectively in large containers.

e) These and other commodities were handled by the redistribution system which emerged in the third millennium to form the basis of the later palace economies.

f) The diet was supplemented, but only to a limited extent, by the usual neolithic range of domestic animals, and by fish.

Factors favouring development in the subsistence subsystem:

B1. New metal tools increasing agricultural efficiency.

B2. Stimulus on production of the redistribution system, both by the wish to receive redistributed goods, and by sanctions applied if quotas were not met.

B3. Social factors, including the use of prestigious drinking vessels, augmenting the demand for wine.

B4. The use of oil lamps augmenting the demand for olive oil (minor factor).

B5. The desire to acquire new craft products in exchange.

B6. The development of overseas trade favouring production increase.

B7. The requirements of subsistence commodities for religious offerings stimulating production (minor factor).

B8. Pressure for increased food production brought about by population increase.

C. Metallurgy

a) Metallurgical output increased dramatically in the early bronze age, and especially in the Early Bronze 2 period. It followed the limited production of copper and of gold in the final neolithic.

b) The metallurgical skills emerging during the third millennium included:

- i. Alloying of copper with tin or with arsenic to yield bronze.
- ii. Smelting and casting of lead.
- iii. Hammering of gold and silver to produce attractive decorative shapes.
- iv. Raising of sheet metal to produce metal vessels.
- v. Use of rivets.
- vi. Production of wire.
- vii. Ornamentation by granulation.

c) The dagger and spear of bronze both made their appearance. The dagger evolved during the early bronze age to yield the sword.

d) Useful metal tools, including large flat axes and shaft-hole axes were produced.

e) A whole series of smaller craft tools, including awls, borers and gouges was produced.

f) Jewellery and articles of adornment in gold, silver and bronze were now made.

Factors favouring growth of metallurgy subsystem

C1. Developments in the field of craft technology, notably pyrotechnological discoveries of the potter.

C2. The need for weapons arising through the increase in military hostilities.

C3. The desire for objects of display.

C4. The custom of burying valuable metal objects with the dead, which removed them from circulation.

C5. Effective supply of raw materials now available from overseas through trade.

D. Craft Technology

a) Craft specialisation is implied by some of the products of the time – engraved seals, for instance, or faience – and direct evidence, although rare, yielded by finds from several sites.

b) A new range of tools furthered the traditional crafts like carpentry and masonry.

c) Several crafts, like those of the shipwright and of textile

production, were transformed through the creation of new products, through specialisation, and by the availability of new tools.

d) A number of entirely new crafts – the skill of the lapidary, of the faience producer, of the jeweller – came into being.

e) The outcome of these advances in craft technology was a whole new range of craft products, best exemplified in the first palaces with their well-dressed masonry, their rich furnishings, and later their fresco decoration.

Factors favouring growth of craft subsystem:

D1. Craft specialisation, made possible by increased agricultural production.

D2. Concentration of resources by redistribution, supporting craft specialisation at the redistribution centre.

D3. Increased population, passing the population threshold for craft specialisation in the village unit.

D4. New metal tools making possible an entire range of new crafts (the stonemason, the sculptor, the shipbuilder, etc.).

D5. Religious representation and the sumptuous decoration of living spaces in the palaces requiring craft specialisation.

D6. The trade in oil, perfume, textiles, etc., favouring specialist craft production.

E. Social Systems

a) Objects of value, doubtless implying considerable prestige, are clearly recognisable for the first time in the third millennium. Often they are of metal – weapons of bronze and plate of gold and silver. This is the first clear expression of wealth in the archaeological record.

b) A growing disparity between rich and poor is documented by grave goods from the third millennium onwards.

c) Objects of symbolic importance – diadems and weapons of display – indicate the emergence of a hierarchy in social as well as economic terms. This is supported by the large central buildings at several proto-urban sites.

d) A developing notion of property is indicated by the seals and sealings in the third millennium.

e) The redistribution system developed, anticipating that of the first palaces, in both Crete and southern Greece.

f) Organised warfare, with specialised weapons of offence and stone fortifications for defence, now developed.

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g) With war came the emergence of warriors, well documented by graves containing several weapons and heralding those of the late bronze age.

h) Several of these developments make the notion of the rise of chiefdoms at this time an appropriate one.

Factors favouring the development of the social subsystem:

E1. Diversity in subsistence production leading to a redistribution system.

E2. New forms of visible and prestigious wealth (the product of metallurgical and other craft production) encouraging the emergence of hierarchical distinctions.

E3. Visible wealth provoking competition and war.

E4. New weapons facilitating war and the emergence of the warrior class.

E5. Writing, aiding redistributive administration.

E6. Increase in population favouring social definition by roles (e.g. craft profession) rather than by kinship.

F. Projective Systems

a) Concepts of measurement, both of weight and number, were clearly formulated. Standards of measure may already have been set up.

b) Symbolic expression of meaning (on seals) already anticipated the development of hieroglyphic writing in the second millennium.

c) The representation of forms from the world of nature, in painting and sculpture, first animals and then plants, became more accomplished.

d) A more complex religious symbolism emerged.

e) Burial of the dead in built graves, either singly or collectively, became widespread. The dead were accompanied by grave goods.

f) Several musical instruments were now available, for both song and dance.

g) A whole new range of decorative techniques was developed, and coherent styles may be distinguished.

h) New rituals and games are documented at this time.

Factors favouring development of projective subsystems:

F1. Craft specialisation necessitating exchange and hence the formation of concepts of equivalence, of weights and measures.

F2. The developing social system favouring new forms of symbolic expression.

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F3. The changing social order encouraging corresponding changes in the religious order.

F4. Contact with other lands leading to innovations in artistic expression and religious symbolism.

F5. Improved craft technology offering new means of expression, both in art and in music.

F6. The increasing population promoting new forms of play and ritual, e.g. the bull sport.

G. Trade and Communication

a) Reciprocity was gradually replaced by redistribution during the third millennium as the principal mechanism for the transfer of goods within the social unit.

b) Reciprocity, doubtless through gift exchange, remained an important mechanism for the transfer of goods between territories.

c) The directional or commercial trade of the later bronze age is heralded, at least in Crete, by the freelance trade which may account for finds of ivory and other materials imported from the Near East and Egypt.

d) Contacts between the Aegean and other Mediterranean areas were few during the third millennium, although communication between Crete and Egypt was established by the end of the final neolithic.

e) Contacts within the Aegean became especially numerous during the Early Bronze 2 period, so that one may speak of an international spirit at this time.

f) The objects most widely distributed in the Aegean were metal weapons, tools and vessels. Pottery forms imitating those of metal are widely found.

g) Transport in the Aegean was always principally by sea, although carts are documented from Crete.

Factors favouring the growth of the trade and communication subsystems:

G1. The increased diversity in subsistence products.

G2. The wide range of new and desirable products of metal.

G3. The pressing need for raw materials, especially metal.

G4. The emergence of new craft products, especially textiles and olive oil.

G5. Improved ships.

G6. The wealth and high status of chiefs, promoting the exchange of luxury goods.

G7. New forms of expression permitting new modes of communication by artistic and symbolic means.

The developments set out in this list are changes in the culture system, documented or at least suggested by the archaeological record. With them are listed changes elsewhere, in other subsystems, tending to favour the developments taking place.

A number of these contributory factors constitute, along with the change they favour, simple positive feedback loops. For example the production of new commodities, such as metal objects or perfumed oil, tended to increase trade, while increased trade stimulated increased and more efficient craft production. At first sight such statements seem almost tautologous: demand favours production, and production promotes demand. On the contrary, however, they are highly meaningful – increased production does not necessarily promote demand: the converse is often true – and their apparent simplicity should not mask their decisive influence upon growth. Two analogous views to these may be contrasted; food production efficiency determines population density (Malthus), and population density determines food production efficiency (Boserup). In fact when increased food production efficiency favours population growth, and increasing population favours food production efficiency, the positive feedback sets up a sustained growth cycle for just as long as the two propositions remain true. These simple feedback loops are the very basis for culture growth.

These positive interactions are indicated in table 1, and the pattern of their interactions as well as their persistence during change in other aspects of the society, and their strength, determine the growth of the culture. The multiplier effect, the positive interaction between subsystems which comes into play allowing sustained growth, may be said to have brought about the emergence of Aegean civilisation, just as it brought about that of other civilisations. The precise way in which it operates, and the nature of the resultant society which the process creates, are determined by the specific nature of the matrix of interactions. They are themselves, of course, governed both by the natural environment and the initial conditions of the culture whose changes are being studied.

Here, then, is a general model for the growth of culture, sufficiently adaptable to accommodate any initial conditions, whether environmental or social. The matrix of interactions determines the nature and the speed of growth.

Two serious limitations are at once apparent. In the first place,

the explanation for growth is descriptive, qualitative, and does not make predictions in precise quantitative terms. This is a regrettable but not insuperable difficulty: economists and geographers increasingly formulate quantitative predictions, and sociologists no doubt will soon follow. A much more serious objection is that we have at present no effective criterion for judging whether or not the postulated interaction is significant at all. A whole range of mechanisms could be postulated to relate any pair of subsystems in a whole variety of different ways. Were this objection to be sustained, the whole explanatory model offered here would indeed be a logical abstraction without any possible practical application.

This apparent weakness is, however, shared by nearly every historical or processual explanation. In outlining a causal chain for the development of a culture or a society, some of the links or steps in the chain inevitably involve human beings, and interaction between them and their environment. Regularities in response are dependent upon regularities in human behaviour. Ultimately an explanation which fails to recognise this will have limitations as serious as an explanation for the behaviour of chemical compounds which refuses to consider the behaviour of the constituent molecules. The multiplier effect model, far from avoiding this difficulty, inherent in any historical or processual explanation, highlights the significance of these human interactions which are at the root of all culture change.

Ultimately the evaluation of the causal links between events raises real philosophical questions. The prehistorian or historian is faced with Russell's paradox of the Two Factory Hooters, sounding simultaneously in two remote cities, A and B, so that workers at A might be said by an external observer to stop work *because* of the hooter at B. When a given consequence in the past *seems* regularly to flow from a specific cause, can we really establish a causal relationship? Indeed we are in greater perplexity, since it is difficult even to establish the true constant conjunction of events in the past. The philosopher's solution is to establish a spatio-temporally continuous chain of events between the occurrences at A and B, 'an intermediate chain of events, some of which are outside the body, some of which are in the ear, some of which are in the auditory nerve, some of which are in the brain' (Braithwaite 1953, 308). When dealing with the growth of human societies, the varieties of human behaviour are an inevitable, if inconvenient, component implicit in all explanations.

That interactions between subsystems, and interactions of eco-

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nomic, social and spiritual forces operating upon the human individual, are given prominence is thus not necessarily a weakness in the multiplier effect model. These are fields which the archaeologist understandably avoids, since his evidence relating to them is often so inadequate. Yet while the behaviour of the group, of many individual units, may often effectively be described in statistical terms without reference to the single unit, it cannot so easily be *explained* in this way. This is a problem which prehistoric archaeology has yet to resolve: nothing is to be gained by avoiding it.

The Human Basis for the Multiplier Effect: Interactions among Human Activities

The crucial interactions between the various fields of human activity (the subsystems of the culture system) whose effective operation has been termed the multiplier effect, have been identified as indispensable to sustained growth. Their precise nature and origin must now be considered.

The interactions among the subsystems of the society take place chiefly at the level of the human individual, since the subsystems of a culture are defined ultimately by the activities of individuals. It is the individual who equates wealth with prestige or social rank, for instance, or who forms for himself a projection of the world where social roles and religious concepts both find a place. Here certain essential differences between human and animal behaviour, differences fundamental to the growth of human culture, deserve more comment than they have received from archaeologists.

Recent studies in animal behaviour have indeed revealed a whole range of activities analogous to those which, in humans, are felt to respond to secondary or derived needs rather than to the primary needs of animal existence. Their adaptive significance, like that of many human activities, is not always obvious. A striking instance is display, sometimes competitive display, among members of the same species. Another is the social hierarchy or 'pecking order' established among some social groups of animals. These and other instances of social behaviour, such as territoriality, narrow the gulf which was formerly thought to separate human and animal behaviour. But in other fields this gulf remains a very real one.

The social activities of man are not always expressed in purely social terms. Social hierarchy can indeed be established by personal combat – a purely social form of contact – but more commonly among humans it is determined in other ways. Social actions are effected more often in material terms – by display of material

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wealth, for instance, or by gifts of valued objects. Out of this equation of material objects and social activities or values, which in cold logic are simply not equivalent, existing as they do in different dimensions, arises the whole complex pattern of interactions among human activities such as those which we have been describing. Such links among the activities in different dimensions of the human individual make possible the links between the subsystems of the culture system which allow the operation of the multiplier effect.

The essential kernel of many of the interactions between activities and between subsystems, interactions which are the mainspring for economic growth, develops from the human inclination to give a social and symbolic significance to material goods. For in this way a whole complex of activities in the material world satisfies aspirations, ambitions and needs which are, at first sight, entirely without adaptive significance in facilitating the continued existence of the individual or the species.

Both the consumption of goods and their storage to ensure later availability are functional activities, in the adaptive sense: they are life preserving. Yet as Veblen (1925) so well expressed,

It is only when taken in a sense far removed from its naïve meaning that consumption of goods can be said to afford the incentive from which accumulation invariably proceeds. The motive that lies at the root of ownership is emulation; and the same motive of emulation continues active in the further development of the institution to which it has given rise and in the development of all those features of the social structure which this institution of ownership touches. The possession of wealth confers honour; it is an invidious distinction. Nothing equally cogent can be said for the consumption of goods, nor for any other conceivable incentive to acquisition, and especially not for any incentive to the accumulation of wealth.

Keynes made the same distinction in writing of the needs of human beings which

fall into two classes – those needs which are absolute in the sense that we feel them whatever the situation of our fellow human beings may be, and those which are relative only in that their satisfaction lifts us above, makes us feel superior to our fellows. (Quoted by Galbraith 1969, 145)

This pecuniary emulation is one of the fundamental objectives of the Acquisitive Society, or the Affluent Society. Prestigious goods were evidently valued in the third-millennium Aegean, and while their distribution may have been governed largely by existing con-

ventions, their increasing importance cannot be so explained. Factors may already have been operating of a kind which we recognise today:

Property now becomes the most easily recognised evidence of a reputable degree of success as distinguished from heroic or signal achievement. It therefore becomes the conventional basis of esteem. . . . The possession of wealth, which was at the outset valued simply as an evidence of efficiency, becomes, in popular apprehension, itself a meritorious act. Wealth is now itself intrinsically honourable as it confers honour on its possessor. By a further refinement, wealth acquired passively by transmission from ancestors or other antecedents presently becomes even more honorific than wealth acquired by the possessor's own effort. (Veblen 1925, 28–9)

In the third-millennium Aegean wealth and status were undoubtedly closely related to kinship, as doubtless in neolithic times. Yet the development of new classes of goods, offering new and tempting scope for the acquisition of wealth, was instrumental in the transformation of a self-sufficient peasantry in Aegean society to the acquisitive proto-urban and later urban citizens of civilisation.

Wealth itself became desirable, and pecuniary emulation was the underlying motive for many activities. Another was display, and the conspicuous consumption of this wealth.

Throughout the entire evolution of conspicuous expenditure, whether of goods or of services or human life, runs the obvious implication that in order to effectually mend the consumer's good fame it must be an expenditure of superfluities. In order to be reputable it must be wasteful. No merit would accrue from the consumption of the bare necessities of life, except by comparison with the abjectly poor who fall short even of the subsistence minimum; and no standard of expenditure could result from such a comparison, except the most prosaic and unattractive level of decency. (*ibid.*, 296–7)

The finery of the Minoan palace, the treasures of the Mycenaean Shaft Graves, the golden drinking cups of Troy, were not conceived solely for the material well-being of those who enjoyed them. They were produced also to signify the wealth of the owner, and to reinforce that impression by extravagance as well as by opulence. Since the owner was the leader, this acted to reinforce his authority and prestige, and hence the effectiveness of his leadership. This conspicuous consumption of wealth is a feature of many agricultural societies, from the potlatch and the gift exchange of barbarism to

the wedding or funeral of Western civilisation. The scope for such display and consumption was greatly increased by the creation of new classes of valuable goods – metal objects, for instance, seal-stones, wine, perfumed oil perhaps, cosmetics – in the third-millennium Aegean, and indeed in the formative stages of many civilisations.

Underlying these expressions of social status, these mechanisms for enhancing reputation and self-satisfaction, is a *symbolic equivalence of social and material values*, an equivalence without which the multiplier effect could scarcely operate. The well-being which comes from the satisfaction of primary animal needs is no longer the chief human goal, but rather the satisfaction accruing from prestige, status and good reputation. These too can sometimes be acquired and expressed through material goods. The material world is now the field for a symbolic competition. During the third-millennium Aegean this symbolic equivalence seems to have become far clearer, and the demand for commodities – a demand which is necessary for the promotion of any new production and hence of any growth in the culture – much more pressing. This symbolic equivalence of social and material values became clearer, too, and somehow more explicit through the formulation of a different kind of equivalence, the equivalence of different kinds of commodities. There is nothing to say that so much, by weight, of flour for instance is the equivalent of a given quantity of copper, and reciprocal exchange, the 'total prestation' (Mauss 1954) of gift exchange with its complex social overtones, avoids this considerable conceptual advance. So too, to some extent, does redistributive transfer, and only markets with explicit exchange rates, and ultimately a money economy make the symbolic equivalence explicit, total and fixed. Yet the redistributive system of the Minoan-Mycenaean palaces, with its quotas and its ration allowances, allowed the equivalence to work in practice.

Both these equivalences are symbolic – they are constructs of the human mind. Their adaptive value is enormous, for they alone make possible the interactions between the various activities of a society. In a sense these symbolic equivalences are the means of communication between the subsystems of a culture, which otherwise would function independently.

Alongside these abstract yet fundamental foundations of civilisation – pecuniary emulation, conspicuous consumption, and the symbolic equivalence of commodities – is a fourth, which ensures that a culture continues to grow even when any reasonable absolute demands of its citizens have been met. This is what economists term

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'income elasticity of demand' – as the saying goes, 'the more you have, the more you want'. The average citizen in a Western society today has a standard of living and a range of material possessions not merely higher than those of his ancestors of three centuries ago, but higher than any to which his seventeenth-century ancestors could have aspired. Yet he does not feel he has enough, that he can sit back and enjoy these material comforts.

The urgency of wants does not diminish appreciably as more of them are satisfied. . . . When man has satisfied his physical needs then psychologically grounded desires take over. These can never be satisfied, or in any case no progress can be proved. The concept of satiation has very little standing in economics. (Galbraith 1969, 138).

Once again it was Thorstein Veblen who most clearly expressed an essential principle of wide although not universal validity, that whatever the normal average standards of society, this standard will still seem inadequate and insufficient to those who have attained it.

As fast as a person makes new acquisitions, and becomes accustomed to the resulting new standards of wealth, the new standard forthwith ceases to afford appreciably greater satisfaction than the earlier standard did. The tendency in any case is constantly to make the present pecuniary standard the point of departure for a fresh increase of wealth: and this in turn gives rise to a new standard of sufficiency and a new pecuniary classification of one's self as compared with one's neighbours. . . . However widely, or equally, or 'fairly', it may be distributed, no general increase to the community's wealth can make any approach to satiating this need (for wealth), the ground of which is the desire of everyone to excel everyone else in the accumulation of goods. If, as is sometimes assumed, the incentive to accumulation were the want of subsistence or of physical comfort, then the aggregate economic wants of a community might conceivably be satisfied at some point in the advance of industrial efficiency; but since the struggle is substantially a race for reputability on the basis of an invidious comparison, no approach to a definitive attainment is possible. . . . The strain is not lightened as industrial efficiency increases and makes a lighter strain possible, but the increment of output is turned to use to meet this want, which is indefinitely expandable, after the manner commonly imputed in economic theory to higher or spiritual wants. It is owing chiefly to the presence of this element in the standard of living that J. S. Mill was able

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to say that 'Hitherto it is questionable if all the mechanical inventions yet made have lightened the day's toil of any human being'. (1925, 31–2, 111)

Here is one of the ultimate and hidden sources of change and progress in society, an unremitting influence favouring sustained and increasing growth in human culture. Of course social emulation and the conspicuous consumption of wealth are not the only aspects of behaviour which lead to this crucial, symbolic equivalence of social and material values. Other societies have different sets of personal values, other goals and motivations, and those discussed here perhaps seem to us appropriate precisely because they are very much those of our own acquisitive, consumer society. The desire for status or prestige may be a common feature of most societies, but in many it is rather modesty, and parsimony in the acquisition or consumption of material goods which are likely to enhance them. Yet it does seem that, for the multiplier effect to operate, the 'currencies' in the different systems of society must come into some kind of equivalence in this way. Aegean civilisation came about, as doubtless did most early civilisations, as the social and material equivalences just described were established. It was these equivalences which enabled the activities of one subsystem to be relevant to those of other subsystems. Interactions were established which permitted, in a variety of ways, the operation of the multiplier effect. The related developments and innovations in the coupled subsystems, in the several yet now related fields of action, were able to overcome the conservative and homeostatic effects of culture and to sustain a growth not simply in size or scale but in diversity and complexity. The working of the multiplier effect is dependent entirely upon the development of such interaction between the subsystems of a culture, and these interactions become possible only through the formulation of symbolic equations like those mentioned. Population increase, another supposed prime mover for culture growth, does not so readily bring about changes of structure: civilisation is not merely the product of population increase. Civilisation comes about through social change coupled with material advance: neither can long be sustained without the other.

[1972]

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